THE INVENTION OF WIRELESS RADIO COMMUNICATION

Contrary to popular thinking, it was not Marconi or even Tesla who invented the wireless transmission of radio waves, but an American dentist, Mahlon Loomis.

by Philip S. Callahan, PhD © 1999

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Harry Callahan, a renowned photographer who won the National Medal of the Arts in 1997, died Monday in Atlanta at eighty-six. Like Ansel Adams and Alfred Stieglitz, Callahan was considered a master of his art, but, unlike them, he wasn't a household name. He was known for his expansive eye, imaginative techniques, passionate work ethic and for being as creative in his 80s as he was in his 30s.
— *Gainesville Sun*, Florida, USA, March 18, 1999

In World War II, I was an invisible radioman, operating by myself in Ireland. My brother fought in the unknown (invisible) 17th Airborne Division. Harry Callahan is the invisible photographer. In today's journalistic-driven society, many photographers have attained great fame. I am a photographer myself, and in my early days I worked as a freelance photojournalist; however, I do not recall ever seeing a single photo by that renowned photographer.

Callahan, however, comes off better than the invisible inventor of radio communication, Mahlon Loomis. The US Federal Government not only never awarded Loomis a medal, but did in fact 'steal' his invention, assuring that Marconi received all credit for radio systems.

I suppose, in reality, if we go back far enough we could credit Ben Franklin with discovering radio—although he did not know it at the time. Everyone knows all about Ben Franklin's rather dangerous experiment with kite and string. A Russian scientist (whose name I no longer remember) was electrocuted while trying to repeat the experiment. That is an indication that perhaps the experiment was not very smart—a fact no one wishes to attach to Ben's name. A much safer and, indeed, more brilliant kite experiment was performed by the dentist Mahlon Loomis.

Mahlon Loomis was born in Oppenheim, New York, on July 21, 1826, the son of an English immigrant father from Essex. He became a dentist, and early in his career practised in Cleveland, Ohio. *He* is the true father and inventor of radio communications and also of the radio antenna—and *not* Nikola Tesla, whom I so admire, or Marconi, who was an entrepreneur.

Although Tesla did not invent radio, he did invent the *tuned circuit* which *controls* radio. Tesla's invention would be analogous to the Wright brothers, who did not invent gliding but invented the control of gliding with wing flaps and a propeller.

There is no question at all that in 1866 Loomis gave the first demonstration of "telegraphing through the air", i.e., without wire connections. This undeniable fact is recorded in the *Saturday Review* of March 7, 1964 in an article, "The Real Beginning of Radio", by Otis B. Young (pp. 48-50). Also in 1964, *Electronic Illustrated* printed an article by Robert Hayes, titled "Who Really Invented Radio" (pp. 83-85). The decade of the 1960s seems filled with articles about Loomis, but few have been written since.

That deluge of papers was probably due to a drive by Otis B. Young of Southern Illinois University at Carbondale. His elegant discussion of Mahlon Loomis's experiment appeared in the *Transactions of Illinois Academy of Science* (vol. 60, no. 1, pp. 3-8, 1967). It is best to quote Young, who gives the notebook description of Loomis's innovative experiment word for word (my emphasis is in italics):

> October 1966 is the centennial month of the first public exhibition of two-way aerial wireless communication of radio. Mahlon Loomis (1826–1886), ingenious dentist of Washington, DC, performed and demonstrated this experiment between

the fifteen-hundred-foot Bear's Den and Catoctin Mountains of the Blue Ridge of Virginia, a distance of about twenty miles. *He thus demonstrated an effect which he described in a notebook dated February 20, 1864. This year should be recognized as the date of his discovery.* In another notebook, he described his October 1866 public demonstration. He wrote:

"Two kites were let up—one from each summit—eighteen or twenty miles apart. These kites has each a piece of fine copper wire gauze, about fifteen inches square, attached to their underside and connected with the wire, six hundred feet in length, which held the kites when they were up. The day was clear and cool in the month of October, with breeze enough to hold the kites firmly at anchor when they were flown. Good connection was made with the ground by laying in a wet place a coil of wire, one end of which was secured to the binding post of a galvanometer. The equipments and apparatus of both stations were exactly alike, the time-piece of both parties having been set exactly alike. It was arranged that at precisely such an hour and minute, the galvanometer at one station should be attached or be in circuit with the grounded and kite wires. At the opposite station, the ground wire being already fast to the galvanometer, three separate and deliberate half-minute connections were made with the kite wire and instruments. *This deflected, or moved, the needle at the other station with the same vigor and precision as if it had been attached to an ordinary battery.*

"After a lapse of five minutes, as previously arranged, the same performance was repeated with the same result until the third time. Then fifteen minutes precisely were allowed to elapse, during which time the instrument at the first station was put in circuit with both wires while the opposite one was detached from its upper wire, thus reversing the arrangements at each station. At the expiration of fifteen minutes, the message or signals came to the initial station, a perfect duplicate of those sent from it, as by previous arrangement. And although no 'transmitting key' was made use of nor any 'sounder' key to voice the messages, yet, they were just as precise and distinct as any that ever sped over a wire. *A solemn feeling seemed to be impressed upon those who wit - nessed the performance, as if some grave mystery hovered there around that simple scene, not withstanding the results confidently expected.*"

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It is of utmost importance to observe that this experiment, as described, was successful: a code system could be used and messages sent. Yet, of the few persons who, during the past one hundred years, reviewed the work of Loomis, a high percentage made the *grave 'scientific' error of concluding that the experiment could not succeed because Loomis did not have the Branley coherer and therefore he had no means of detecting the signals.* This false conclusion weakened seriously the cause of Loomis.

In further defense, various persons have repeated his experiment and found his report accurate. The author has made test experiments and determined that *the wave form emerging from the kite wire was a rapidly damping pulse which would give a direct-current instrument, a moving needle galvanometer, a ballistic deflection.* A radio frequency component on the pulse would make no difference in the reception, as the two stations were tuned the same.

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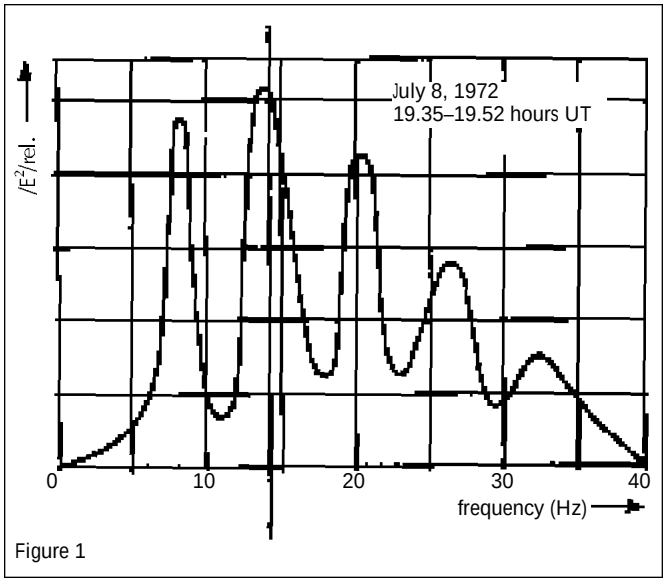

Figure 1

To understand exactly how Mahlon's system worked, it is necessary to understand the place of lightning in generating ELF (extremely low frequency) radio waves in the atmosphere.

Young states in his article that "the wave form emerging from the kite wire was a rapidly damping pulse". The pulse was, of course, a surge of current (amps) that caused the needle in the galvanometer (ammeter) to deflect.

Since there was no battery attached to the circuit but only a meter between ground and the kite wire, where did the current come from and how could Loomis detect it without a radio wave detector? The earliest radio wave detector, called a *coherer*, was not invented until a few years later.

As Young points out, Loomis had the usual problem of being an inventive individual with the stuffed-shirt arrogance of some, not all, of hallowed academia. But such pontificators never leave

their desks; instead, they climb to exalted positions, usurping the work of the innovative. Nikola Tesla, the poor immigrant Serb, knew all about that phenomenon of life's unfairness. No electrical engineering school ever gave Tesla the time of day, and General Electric stole all of his inventions. Sadly, both Tesla and Loomis withdrew from the excitement of day-to-day life.

In 1954, W. O. Schumann and H. L. Konig wrote a paper on the radio frequencies generated by lightning in the atmosphere. Schumann fared better than Loomis, since the low-frequency-radio components of such atmospheric frequencies are called *Schumann waves*.

During the 1950s and 1960s, Konig studied those waves in detail. He discovered that such waves are generated by the 2,000 to 4,000 lightning strikes that occur around the world each day. The ionosphere above the Earth forms the upper layer of a huge, resonant cavity filled with atmosphere. The lightning stimulates the long-wave radio waves which resonate in the Earth-ionosphere spherical cavity. As in any cavity-resonant system, the energy 'focuses' and forms standing waves at certain wavelengths (see figure 1).

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The atmospheric spectrum of radio frequency is divided into two regions. The first is the ELF region of extremely low frequencies below 1000 hertz (1 Hz = 1 cycle per second). The second is the VLF (very low frequency) region from 1000 Hz (1 kilohertz) to 50,000 Hz (50 kHz).

The radio broadcast band goes from 500 kHz to 1700 kHz, far above the atmospheric region. Work by Toomey and Polk shows that the main 'foci' of atmospheric standing waves in the United States and most of the world are 8, 14, 21, 27 and 33 Hz (see figure 2). The main standing wave in Florida, as in most of the United States, is 14 Hz.

Professor Toomey, in his excellent review article, writes about the difficulty of measuring the ELF waves:

> It is particularly difficult to measure signals with frequencies below 100 Hz, due to interferences of technical origin (for example, the 50 Hz or 60 Hz power current frequencies and the 25 Hz telephone ringing signal), whose intensity is usually far above that of fields of natural origin. They must be suppressed by means of a suitable filtering technique. Furthermore, these low frequencies, both in electric fields (Clayton *et al.*) and in magnetic fields (Konig), present special antennae problems.

At the time of Mahlon Loomis, nothing was known of the lightning-generated ELF standing wave frequencies. The desk professors therefore decided that, since there was no battery, there could be no electrical waves. They apparently had never heard of Ben Franklin's elegant and dangerous experiment.

It is easily understood that the voltage and current from the ELF and VLF waves, that are generated by lightning, furnished the current to both the receiving and transmitting wire kite antennae.

Why did Loomis not need a detector? Young answers that question himself. When Loomis opened and closed his meter circuit, he created a huge surge of current in the form of a rapidly damping pulse. Since both kite wires were connected to the same surrounding atmospheric battery, they responded in time to the opening and closing circuit—thus the first 'Morse code' transmission without connecting wires: RADIO!

What happened to Mahlon Loomis is indeed a sad story. In 1854, he received a patent for kaolin plates for making artificial teeth. Two years later, he married Achsah Ashley of West Springfield, Mass., and some time in 1860 moved to Washington, DC, where he gave his first public demonstration of wireless communication. In 1868, he repeated the experiment before eminent scientists and members of Congress.

In 1869, the Loomis Aerial Telegraph Bill was proposed and $50,000 in financing was sought. Discussions went on for two years until 1871, when the disaster of the Chicago Fire robbed Loomis of promised financial support.

On July 30, 1872, Patent No. 129917, titled "Improvement in Telegraphing", was issued to Mahlon Loomis. The patent date, 1872, is proof that he did indeed invent radio transmission by antenna.

In 1873, the Capitol Loomis Aerial Telegraph company was chartered by Congress, authorising capital of $200,000, to be increased to $2,000,000. President Grant signed the bill. However, Loomis never saw the money; it was probably diverted by political robbers to somebody else's pocket.

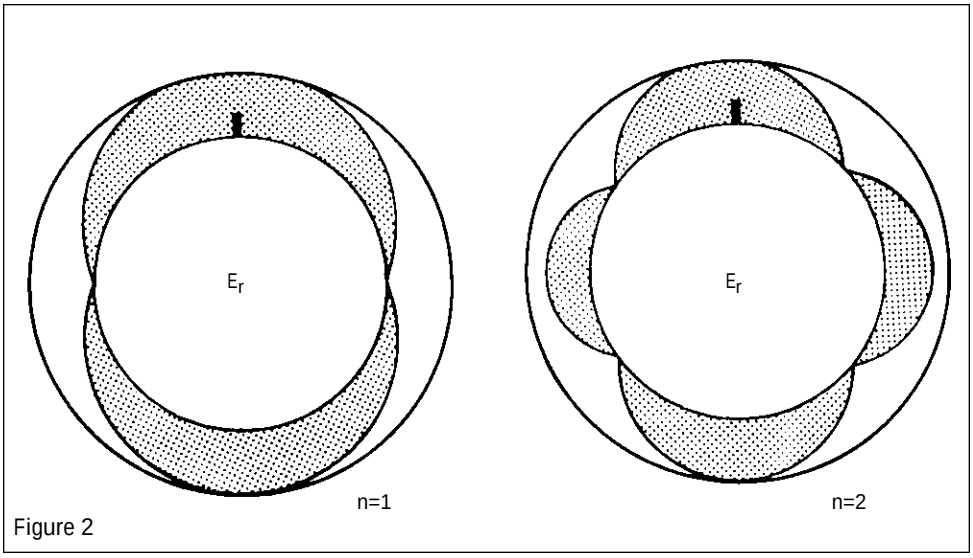

Figure 2

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The Invention of Wireless Radio Communication

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In 1881, Loomis give a speech on his invention to the famous Franklin Institute in Philadelphia—a fitting connection, linking Loomis to his genius predecessor, Ben Franklin.

In essence, Congress had assured his failure. This left the field to Marconi, who was funded with millions of pounds from the British Post Office.

Loomis spent his final days experimenting with steel pipes on wooden towers. He practised dentistry only when necessary, in order to earn money to survive.

I can find very little information on the personal character of Mahlon Loomis. He died at his brother's home in Terra Alta, West Virginia, and is buried, unknown and unheralded, in the local cemetery.

Mahlon Loomis's steel pipes up the side of wooden poles were not unlike my copper wire up the side of the wooden poles of the (low frequency) radio range navigation station, on the border of the Irish Free State, that I kept on the air during World War II.

Our station functioned at 330 kilohertz—that portion of the radio spectrum between 50 kHz and the broadcast frequencies starting at 500 kHz. It is the portion of the radio spectrum called low frequency (LF), and is the portion that Nikola Tesla worked with. Our Magheramena radio range was thus a low-frequency Tesla station—and I, at 18 years of age, had been trained by the Army Air Force in Tesla science.

Low frequencies were used for two good reasons. The first is that instead of shooting up into the sky, like high frequencies, they hug the surface of the Earth and thus lend themselves to Earth-hugging beams. The second, of course, is that the Germans utilised no low frequencies, so they never picked up our transmissions.

The famed twin-tailed Messerschmitt 110E, with a range of 1,800 miles, could easily have destroyed our station. With a speed of 350 mph and service ceiling of 32,000 feet, the 110E could sneak across Ireland.

The BF-110E fighter-bomber was called the *Zerstörer* (Destroyer). It was little talked about during the war, although it was without a doubt the best fighter-bomber ever built. The United States could easily have won the Vietnam War with it. It was also an invisible weapon.

Since we were only eight miles from the ocean, where German subs roamed, a more likely demise of our installation—had it been detected—would have been from a German commando raid. Our one .45 and two Thompson submachine guns would probably not have served us very well.

Little did Mahlon Loomis ever imagine that his elegant invention would, less than a century later, be saving thousands of lives of American and British airmen and merchant seamen. ∞

About the Author:

Philip S. Callahan, PhD, is a rare combination of scientist, natural philosopher and world traveller. He is the author of numerous scientific papers as well as 14 books, including *Insect Behavior* (1971), *Tuning in to Nature* (1975), *Birds and How They Function* (1979), *Ancient Mysteries, Modern Visions* (1984), *Nature's Silent Music* (1992), *Exploring the Spectrum* (1994), *Paramagnetism* (1996), and *My Search for Traces of God* (1997)—a very personal memoir that describes his own spiritual development, the influence of divine guidance on his discoveries, and the physics of miraculous events (see review in 5/06).